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In This Issue

The first two articles in this issue discuss costs-of-production (COP) estimates, the first highlighting conceptual problems and the second proposing an approach that resolves some, but not all, of the problems. The difference between the proposed approach and most other research proposals is that legislation requires that estimates be calculated, whether or not the conceptual issues have been resolved.

The main conceptual issue arises in assigning a value to agricultural land, an important component in COP estimates. Economic theory indicates that the opportunity cost of specialized inputs cannot be calculated independently of demand, and thus, of product price. However, if the product price is set to cover the cost of the specialized input, the following three issues which Harrington identifies in the first article arise: (1) circularity (do production costs determine product prices or vice versa?), (2) potential cost-price spirals, and (3) escalating land values. Harrington further illustrates the distortions that inflation, income tax considerations, and the use of credit may introduce to land values, to interest costs, and, consequently, to COP estimates.

Hoffman and Gustafson, in the second article, address Harrington's second set of issues by proposing that COP estimates separate current costs and returns from longrun costs and returns. However, they do not resolve the valuation of land issue, but instead apply the longrun real rate of return on assets invested in agriculture to the current market price, which could be influenced by the forces Harrington identifies. But, Hoffman and Gustafson's format clearly isolates this imputation and others from cash incomes and expenditures.

In COP estimations, as in some other economic applications, analysts attempt to remove the effects of inflation and temporary fluctuations from the nominal interest rate. One line of economic reasoning, that of employing the rational expectations hypothesis, does imply small fluctuations in expected real interest rates. However, high real interest rates, by historical standards, have persisted for some time.

In the Research Review section in this issue, Sundell summarizes the literature on the determination of real interest rates. He concludes that real interest rates have been quite variable because of slow adjustments of wages, prices, and output to changes in the nominal money supply.

Lorna Aldrich

Contents

Costs and Returns: Economic and Accounting Concepts

By David H. Harrington*

Abstract

This article reviews economic and accounting bases for costs-of-production (COP) calculations. It finds that the problems of circularity of arguments, potential cost-price spirals, and escalating land values are inherent in all full COP methods of setting support prices. Inflation, income tax regulations, and credit usage interact to distort the traditional relationships between cash costs and cash returns, thus requiring explicit correction in COP calculations.

Keywords

Costs of production, opportunity costs, inflation, credit, income taxation, land values

Introduction

The U.S. Department of Agriculture is required to calculate costs-of-production (COP) indicators that the Secretary of Agriculture may use to set support prices for major crops and must use to adjust price supports for peanuts.

COP statistics rely heavily on economic theory because over half of production costs are imputed from returns to labor, management, and land—which should be justified by theory. But, what does economic theory say about imputing returns? In general, the return to an input should equal the return it would earn in its next best use—its opportunity cost. However, what is the next best use of a specialized input, such as agricultural land? Economic theory also says that costs of specialized inputs cannot be determined independently of the demand for the product (*2, 6*).[1] The opportunity cost concept is difficult to apply to all specialized inputs, including those specialized to agriculture.

If the difficulties inherent in the imputation lead to cost estimates that are too high or too low and if these estimates influence target prices, artificially induced price spirals may result. In this article, I discuss common accounting and economic frameworks used in COP work, illustrate some of the general problems that can result from miscalculating or misusing estimates, and illustrate how inflation and taxation create specific problems that must be corrected in COP calculations.

Accounting and Economic Costs of Production

To illustrate the accounting concepts underlying both the accounting and economic approaches to COP analyses, I use as an example a 300-acre corn farm with yields and costs representing the 1980 corn COP estimates. The yield was set at 90.5 bushels per acre; operator and family labor input was assumed to be exactly 971 hours; the price received per bushel was $3.82, exactly equal to costs for an owner valuing land at current value; and the owner was assumed to withdraw only the labor and management returns.

Accounting Costs of Production

Costs and returns in an accounting sense arise in the operating statement and in the book- and market-value balance sheets. Table 1 forms a single account using summary information from these three statements. The consolidated account is composed of inflow items (not necessarily returns) and outflow items (not necessarily costs). The entries correspond to the COP methodology established in the 1973 Agriculture and Consumer Protection Act.

*The author is an economist with the National Economics Division, ERS.

[1]Italicized numbers in parentheses refer to items in the References at the end of this article.

Table 1—Accounting costs and returns framework, 300-acre corn farm, 1980 hypothetical data

Inflow items	Dollars	Outflow and residual items	Dollars
Cash items:		Expense items:	
Farm marketings	103,713	Cash production expenditures	35,175
Government payments	—	Business taxes paid	1,119
Borrowings	—	Interest paid	47,379
Sales of capital assets	—	Subtotal, cash expenses	83,673
Owner contributions	—	In-kind payments	—
Subtotal, cash inflow	103,713	Capital consumption allowances	10,266
Noncash items:		Subtotal, noncash expenses	10,266
In-kind receipts	—	Total production expenses	93,939
Net inventory change	—	Owner withdrawal items:	
Total value of capital assets purchased	—	Consumption	9,774
In-kind investments	—	Income taxes paid	—
Undistributed capital appreciation	—	Off-farm investment	—
Subtotal, noncash items	—	Subtotal owner withdrawals	9,774
Grand total inflow	103,713	Residual investment items:	
		Principal payments	—
		Net capital asset purchases	—
		In-kind investments	—
		Undistributed capital appreciation	—
		Undistributed return to equity	—
		Subtotal, residual investment	—
		Grand total outflow and residual investment	103,713

— Indicates items not considered in the COP methods from the 1973 act.

In this accounting framework, the cost of production would be the total production expenses line divided by the appropriate production unit divisor ($93,939/300 acres = $313.13 per acre or $93,939/27,150 bushels = $3.46 per bushel). The net returns to the business owner are, correspondingly, the sum of residual investment and owner withdrawal items ($9,774/300 acres = $32.58 per acre, or $9,774/27,150 bushels = $0.36 per bushel).

Half the cells in table 1 are not filled or, as required by the 1973 act, are filled with values appropriate only for an operator with zero equity and using "interest only" loans. Some of the problems in the methods have been corrected (see Gustafson and Hoffman's article in this issue), but some have not. Ownership and benefits of capital asset appreciation are ignored, as are principal payments, in-kind receipts, and income taxes. The COP methods do not consider the inventories held by operators. Unfilled data cells and unrealistic assumptions mean that true economic costs and economic returns cannot be identified. For example, if the interest paid specifically allows a farmer to own land that is appreciating in value, is the interest payment a cost, an investment, or both?

Economic Costs of Production

To adapt this accounting framework to an economic analysis of responses and price relationships, economists have substituted the opportunity cost princi-

ple (what the asset could earn in its next best alternative use) for the accountant's use of receipts, expenditures, and market values. Using the same 300-acre corn farm portrayed in the accounting framework and in the 1980 corn COP estimates, we obtain the total COP estimates in table 2.

Table 2—Economic cost of production framework, 300-acre corn farm, 1980 hypothetical data

Item	Dollars
Cash production expenses	35,175
+ Capital cost allowances	10,266
+ Business taxes paid	1,119
+ Opportunity cost of 971.25 hours of labor @ $4.00	3,885
+ Opportunity cost of management	5,889
+ Opportunity cost of $473,790 capital invested @ 10 percent	47,379
= Total cost	103,713
Full cost of production (including return to operator):	
$103,713/300 acres =	345.71 per acre
$103,713/27,150 bushels =	3.82 per bushel

Viewed another way, farmers and economists use these same assumptions and procedures to determine the value of the assets used in farming. Table 3 uses the same example, assumes the price received per bushel of corn was exactly $3.82, and derives the value of the assets used by this farm.

Table 3—Valuation of assets, 300-acre corn farm, 1980 hypothetical data

Item	Dollars
Total revenue	103,713
− Business taxes paid	−1,119
− Capital cost allowances	−10,266
− Cash production expenses	−35,175
= Gross margin	57,153
− Opportunity cost of farmer's labor	−3,885
− Opportunity cost of management	−5,889
= Annual cash return to assets	47,379
Capitalizing this annual cash return at 10 percent:[1]	
$47,379/.10 = Value of assets	473,790

[1]Assumes the opportunity rate of return on capital is 10 percent.

Some General Problems

Three considerations render this economic COP framework problematic for policy formulation: (1) the circularity of the calculations, (2) the potential for price spirals, and (3) the incidence of any price spirals primarily on land values (regardless of their source).

Circularity

Tables 2 and 3 show that, if one uses the same assumptions in valuing assets as in calculating costs of production, then the costs of production will *always* exactly equal the price received for whatever period of time one uses—1 year, 5 years, or any other period. Teigen (*7*) most recently demonstrated this relationship. Others stated it as far back as 1919 (see (*1*), p. 251; (*3*), p. 421).

Price Costs Spirals

If COP calculations use different assumptions than farmers (or investors in farm assets) use in valuing their time and assets, then the COP estimates will necessarily differ from the price received for the product. If a higher COP estimate is then used to set prices, continuous price spirals are possible. For example, suppose that farmers (possibly because of tax shelter benefits or expected future increases in the net returns to invested capital) are willing to accept a 5-percent return on their capital instead of the 10-percent return assumed in the COP methods; then, in the asset valuation calculations in table 3, the $47,379 annual cash return to assets becomes capitalized into a value of assets of $947,580. The market value of assets would rapidly adjust to this new level. If the $947,580 value of assets is then used in COP calculations for a subsequent year, production costs, as calculated by the formula, will rise to $5.56 per bushel. If price is then set at the $5.56 per bushel cost of production, the farmer's annual cash flow attributable to assets will rise to $94,758, which again capitalized at 5 percent would yield asset values of $1,895,160. Again, the market value of these assets would rapidly adjust toward this figure. If price is again set according to the new value of assets in the COP formula, the cost of production will be $9.05. This is the price escalator that can result from employing *any* unwarranted assumptions about desired rates of return or asset

values—not just the desired rate of return on land or physical assets.

Incidence on Land Prices

Finally, if any unwarranted assumptions are made—in valuing labor, management, durable inputs, or any other inputs—the resulting price spiral will overwhelmingly come to rest in increased prices for land (unless some durable, transferable pseudo factor, such as a quota or production license is established). This situation results because land is the most durable, least reproducible, and most inelastically supplied factor of production. Indeed, if the longrun supply of other factors is perfectly elastic, *all* the price adjustments will accrue to land values.

Some Specific Problems: Inflation and Taxation

By the late seventies, farmers believed inflation was a relatively permanent part of the economic environment facing agriculture. The interaction of inflation, credit use, and taxation provided economic opportunities that changed the behavior of investors in farmland. These behavioral changes alter the way the economic system performs and have strong implications for COP analysis methods (*5*).

The interaction of inflation, credit use, and taxation has recently been found to:

1. Create a permanent split of returns between current cash income and capital asset appreciation (*4*),
2. Depress the apparent current cash returns to farmland ownership (*5*), and
3. Reduce reportable and taxable incomes in agriculture.

Land Value Capitalization Formula

I derived the capitalization formula used in this analysis from Melichar (*4*) by considering tax savings as equivalent to increases in annual net returns to land. The Melichar formula for maximum bid price is:

$$V_o = R_o \frac{1+f}{r-f} \qquad (1)$$

where:

V_o = the value of the asset in year o,
R_o = expected net return to the asset in year o,
f = expected rate of growth of net returns (equals expected inflation in this example), and
r = required rate of return.

Under the simple and realistic assumption that investors hold the land until death (thereby escaping capital gains taxation), both the capital gains and the annual net return from land investment escape taxation. The former escapes through the "stepped-up basis," and the latter escapes through cash basis accounting for tax purposes and negative net cash flows. Beyond sheltering its own income from taxation, the negative net cash flows also reduce tax liability on other income.

The annual tax savings ($\triangle t$) per dollar of investment (V) is:

$$\frac{\triangle t}{V} = m.d.i \qquad (2)$$

where:

m = the marginal tax bracket,
d = the proportion of purchase price financed, and
i = the interest rate on borrowed funds.

These annual tax savings decline as the loan principal is paid off. Total tax savings are thus limited by a parameter, θ, which reflects the terms and length of the loan and the rate at which it is paid. This parameter may require approximation of complex amortization schedules and discount formulas. In this example, *we* simply assume θ to be 10.0 (implying total benefits are 10 times annual benefits). Combining the total tax savings benefit with the Melichar formula gives:

$$V = (1 + m \cdot d \cdot i \cdot \theta) R_o \frac{1+f}{r-f} \qquad (3)$$

which describes the maximum bidding potential of rational investors expecting constant inflation, expecting to keep their land until death, and valuing each $1 of estate passed on to their heirs the same

as each $1 of wealth accumulated during their lifetime.

Inflation, Credit, and Taxation Interactions

Throughout this section, I use this model of land valuation to successively illustrate the effects of inflation, credit, and taxation on land values and apparent rates of return. Table 4 depicts six ownership situations illustrating different combinations of inflation, debt financing, and tax rates for an identical acre of farmland, and it displays the resulting returns to prospective purchasers, and hence the capitalized value of the land under each ownership situation. For example, an operator (situation 5) with a 20-percent marginal tax rate who financed 80 percent of an acre's value would capitalize it at $1,248, using equation (3). Applying the 5-percent inflation rate yields a $62.40 annual capital appreciation for a total economic return of $162.40, given the expected $100 net cash return. However, interest payments of $154.75 exceed the cash return by $54.75. Applying the 20-percent tax rate to the excess payment yields tax benefits of $10.95. If only the annual net (cash) return to land were considered, the apparent annual rate of return to land would be 8.01 percent ($100/$1,248). In each situation, the effective rate of return from the income sources considered is assumed to be 10 percent.

The ideal situation—how the capital, credit, and taxation systems are supposed to work—is illustrated by comparison of situations 1 and 2.[2] With no inflation, all the net return to land would be taxable and would cover the interest on debt-encumbered land. The difference in taxable cash flows for debt-free versus indebted farm operators would accurately reflect their net incomes. The value of the land to each potential purchaser would be the same, and the current apparent rate of return on farmland would equal the interest rate on borrowed funds—all just as economic theory says they should be. Under these circumstances, a COP accounting system based solely on market returns would accurately reflect the costs and income positions of various farm owners and operators.

[2]In each situation, it is assumed that all potential purchasers of land are as described.

Inflationary Growth in Net Returns. One economic effect of general inflation is that it raises the interest rates required by rational savers and investors by the expected amount of general inflation. Higher expected rates of inflation thereby increase the interest rates lenders charge. We can compare situation 1 with situation 3 to isolate the effects of an expected 5-percent inflation rate. Farmers (and investors) will likely raise their required rate of return to account for expected inflation (to $(1.05)(1.10) - 1.0 = 0.155 = 15.5$ percent).

Now, in addition to the $100 annual net return to land, owners receive an additional $50 in capital appreciation on the value of the land they own. This amount is an "unrealized capital gain"; it is not received in cash, it does not show up in a cash accounting system, nor is it taxed as income. But, it does add to the owner's wealth, and it can be used as collateral for borrowing to expand the farm or to weather a period of adverse prices or production. Because the unrealized capital gain exactly offsets the deterioration in purchasing power of the dollar, the first-year value of the land under this situation would remain at $1,000 for a rational investor, and the current (apparent) rate of return of this acre of farmland would remain at 10 percent. But, the land would appreciate each year at exactly the 5-percent inflation rate.

Negative Cash Flows. Comparing situation 3 with situation 4 shows another impact of inflation—namely, negative cash flows. If a parcel of land which returns $100 per year is purchased for $1,000, of which 80 percent ($800) is debt-financed at 15.5-percent interest, then the cash outflow ($124) for this acre would exceed its cash inflow ($100). The overall economic rate of return would still be favorable because the value of the land will increase $50 per year, for a combined return of $150. Thus, although the transaction would be profitable, it would have to be subsidized from other income sources, such as off-farm income or income from land already owned for which the cash flow was positive. Observe that the cash flow accounting system is no longer applicable; it shows a negative $24 net income for the transactions even though the transaction is still profitable. A cash accounting system which uses the purchase price of assets as an opportunity cost and actual interest payments as cash costs would translate these negative cash flows into higher costs of production.

Table 4—Components of annual returns of farmland and capitalized value of land to different classes of owners, hypothetical data[1]

Ownership situation	Expected annual net return to land	Capitalized value of land[2]	Expected annual capital appreciation of land	Expected annual economic return, excluding tax benefits	Annual interest payments	Expected taxable annual net cash flow	Expected net annual tax benefits	Current apparent annual rate of returns to land
	Dollars per year[3]							*Percent*
(1) No inflation, debt-free purchase	100	1,000	0	100	0	100	N.A.	10
(2) No inflation, 80-percent debt purchase @10-percent interest	100	1,000	0	100	80	20	N.A.	10
(3) 5-percent inflation, debt-free purchase	100	1,000	50	150	0	100	N.A.	10
(4) 5-percent inflation, 80-percent purchases @15.5-percent interest, disregarding tax benefits on valuation of land[4]	100	1,000	50	150	124	−24	N.A.	10
(5) 5-percent inflation, 80-percent debt purchase @15.5-percent interest, 20-percent marginal tax bracket[4]	100	1,248	62.40	162.40	154.75	−54.73	10.95	8.01
(6) 5-percent inflation, 80-percent purchase @15.5-percent interest, 50-percent marginal tax bracket[4]	100	1,620	81.00	181.00	200.88	−100.88	50.44	6.17

N.A. = Not applicable.

[1]Based on a simplified capitalization formula for land that is assumed to be held until death of owner:

$$V = (1 + m.\,d.\,i.\,\theta)\,R_o\,\frac{1+f}{r-f}$$

where: m = marginal tax bracket of purchaser (0, 20 percent, 50 percent);
V = present value of asset;
f = expected inflation rate of net returns to land (0, 5 percent),
r = discount rate (required rate of return, 10 percent);
θ = factor that represents length of loan rate at which it will be paid off (10.0);
d = percentage of purchase price financed (0, 80 percent);
R_o = first-year annual net return to land ($100); and
i = interest rate on borrowed funds (10 percent, 15.5 percent),

[2]Stated as capitalized (present) value of an additional acre of land, assuming all potential purchases are as described in the situation in the table stub.

[3]Stated as first-year values. Under inflationary conditions, returns grow each year at the assumed inflation rate, annual interest payments decline as loans are paid off, and taxable cash flows consequently increase faster than the inflation rate.

[4]Because of expected future inflation, rational savers and lenders increase the interest rates they demand; this is the "Fisher Effect." Similarly, rational investors raise their required rates of return by the same amount.

Tax Effects. Income tax effects are a fourth result of inflation and credit use. Because of (1) the deductibility of interest payments in deriving taxable net incomes and (2) the negative cash flows that occur with debt-financed farm expansion, tax reduction benefits may result from expanding a farm with debt financing. Furthermore, the higher the marginal tax bracket of the investor, the larger the benefits.

Comparing situations 5 and 6 with situation 4 shows the effects of considering the tax avoidance benefits of investment in farmland. The negative cash flows reduce the purchaser's current taxable income. If the land is later sold, the seller then incurs a liability for capital gains tax (at 40 percent of normal income tax rates). Thus, investing in farmland can be used to defer taxes and convert current income into more favorably taxed capital gains. Equally important, purchasers can use such investments to avoid any income tax by holding the land until their death. The value of the land at death is "stepped up" to the fair market value of the land at the time of death, and no income taxes would be due. The wealth accumulated (the higher value of land) would still be subject to the provisions of the Estate Tax (which are more liberal for estates consisting largely of farmland than for other types of estates), but both the income sheltered by negative cash flows and the capital appreciation of the assets will have escaped taxation as income.

This method of reducing current income taxes by investing in farmland by use of debt capital helps explain why 91 percent of new land purchases involve debt financing and 78 percent of the value of such land purchases are encumbered by debt (1980 figures).

One can understand the overall impact of all of these forces—inflation, credit, and tax avoidance—by comparing situation 1 with situations 5 and 6. To a rational investor, the same acre of land increases in first-year value from $1,000 to as much as $1,620 if one successively considers inflation, interest deductions from use of credit, and the income tax-sheltering aspects of farmland investment for taxpayers in different marginal tax brackets.[3]

[3]If investors expect real growth in net returns to land (that is, if the rate of growth of net returns is expected to exceed the inflation rate), then land values can increase from these figures (see (*4*)).

Apparent Rates of Return. The last column of table 4 also illustrates why a cash receipts and expenditures accounting system is not reliable for estimating costs of production during inflationary periods. Over this same progression, the current apparent rate of return to land (which would be reflected in a cash accounting system) drops from 10 percent to 6.17 percent, and the taxable net cash flow drops from $100 (equal to the net return to land) to *minus* $100.88. In each situation, the land resource, the present net return to land, and the required percentage return on investment (from all sources) are identical. Thus, rational investors—considering expected inflation, interest rates, and tax avoidance benefits of investing in farmland—can bid over 1.5 times the initially apparent value for farmland and still achieve their target rates of return. Furthermore, their bidding ability is greater the higher their marginal tax bracket, the higher the inflation rate, and the more additional unencumbered assets or other income they have that will cover any negative cash flows arising from purchasing farmland.

If the COP framework ignores these noncash returns from asset appreciation and tax sheltering or ignores the in-kind investments associated with certain livestock or orchard operations, a number of unwarranted assumptions are built into the system. In certain types of production units, these returns can overwhelm the cash returns—for example, the land appreciation on land-based enterprises, breeding herd expansion for dairy for beef enterprises, tax treatment of breeding and dairy livestock enterprises, and the "current expensing" of orchard development expenditures. In any complete accounting system, these returns must be considered as additional income not realized from the marketplace. As demonstrated, many of these nonmarket returns do not depend on the size or efficiency of the farm, but rather on the marginal tax bracket of the owner/investor. Large expected capital gains reduce the economic costs of production, and expected capital losses increase the economic costs of production. Under some circumstances, the existence of strong nonmarket returns can make market returns negative.

Attempting to enforce the old desired rates of cash return, ignoring the inflationary and tax avoidance returns to farmland ownership, or ignoring in-kind

investments will compound the tendency of COP formulas to spiral upwards. To be consistent and to prevent price spirals, if one excludes capital gains and losses from the COP framework, then one must also exclude the investments that support them. Thus, both interest rates and desired rates of return used in COP calculations must exclude inflation. One must also exercise extreme care in splitting costs into current production costs and implicit investments—especially in livestock production.

Summary

In summary, one should remember the following general conclusions about all COP analyses:

(1) They are essentially circular arguments; if one uses the same assumptions in determining the costs and in valuing the assets used, then the costs of production will *always* exactly equal the price received for the product.

(2) Any unwarranted assumptions about the desired rate of return of farmers or investors will create a self-feeding price spiral, if one uses COP results to set prices.

(3) Any price spirals will overwhelmingly come to rest in increased values of agricultural assets—especially land values.

(4) Inflation taxation and credit interact to make cash accounting analysis unusable for full economic COP estimates under inflation.

(5) If an incomplete COP framework is designed (that is, excluding net investments and capital appreciation), then the expenditures that contribute to the net investments and capital appreciation must also be excluded. This situation generally means removing the inflation component from interest payments and required rates of return and explicitly identifying in-kind investments such as occur when one raises replacement livestock or establishes orchards.

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A New Approach to Estimating Agricultural Costs of Production

By George Hoffman and Cole Gustafson*

Abstract

Current concepts and procedures used by the U.S. Department of Agriculture (USDA) to estimate farm enterprise costs of production are inadequate for describing economic conditions of various producer groups. The 1981 Agriculture and Food Act gives USDA greater flexibility in estimating production costs. This article describes new procedures for developing estimates that deal with problems of unrealized farmland capital gains, cash flow, and returns to the resources of production.

Keywords

Costs of production, returns, land values, opportunity costs

Introduction

Substantial public debate in recent years has focused on costs-of-production (COP) statistics (*4, 9, 10*), especially since the Agriculture and Consumer Protection Act of 1973 required USDA to conduct COP studies.[1] Although the 1973 legislation did not tie farm program support levels directly to COP estimates, the 1977 act authorized adjustments in target prices based on changes in production costs. The Agriculture and Food Act of 1981 does not contain specific requirements for adjusting support prices (except for peanuts); however, the act does allow the Secretary of Agriculture to raise supports above established minimum levels to reflect increases in production costs.

In recent years farmers have expanded production for some commodities even when USDA estimates have shown that production costs are not being covered. If producers are rational, this suggests USDA cost estimates may have been too high, returns may have been underestimated, or a combination of both may have occurred. A major conceptual problem with current methods could explain this situation. Current methods compare longrun costs, including full opportunity cost, with current returns for production. Thus, some returns from investment in agricultural production resources, primarily capital appreciation of farmland, are neglected when one compares total costs only with shortrun or current returns from production.

If COP figures are to be meaningful indicators for policymakers or are to be used to describe accurately the economic condition of producer groups, researchers must separate asset valuation criteria appropriate for full economic cost analysis from those appropriate for cash flow analysis. The Agriculture and Food Act of 1981 permits the modification of methods for valuing returns to operator supplied inputs, primarily land charges, labor, and management.

This article proposes new procedures for valuing and allocating the returns to resources used in production and a new format for reporting enterprise COP statistics. These new procedures separate current costs from longrun costs, thus making cash-flow analysis independent of full economic cost analysis.

*Hoffman is the Associate Administrator of ERS and Gustafson is an agricultural economist with the National Economics Division, ERS. The authors wish to thank Ken Baum, Richard Crom, Milton Ericksen, Henry Gilliam, Verner Grise, David Harrington, Jim Johnson, Ronald Krenz, Gene Mathia, Thomas A. Miller, Robert E. Olson, and Hosein Shapouri for their contributions.

[1]Italicized numbers in parentheses refer to items in the References at the end of this article.

Problems in the Current Methods

Section 808 of the 1973 act specified that COP studies must include "a return on fixed costs equal to the existing interest rates charged by the Federal Land Bank (FLB)" and a "return for management comparable to the normal management fees charged by other comparable industries." These two provisions create major conceptual and estimation problems when the costs of production for selected commodities are computed.

Costs of labor, management, and equity in land and equipment are major components of total costs under current procedures, but they are implicitly estimated as opportunity costs. For example, about half the total cost of producing corn accrues from implicitly estimated opportunity costs. Consequently, small differences in assumptions concerning these imputed budget items can cause estimates of total costs to differ substantially. Because of the high proportion of opportunity cost imputations in the budgets, current production cost estimates may not accurately reflect economic conditions of the subsector.

Total returns may differ considerably from current ones when anticipated future returns are neglected. Future returns may be in the form of an increasing current income stream or (unrealized) appreciation of assets. Through the seventies, the capital gain on farmland was the primary future return associated with farming.

Use of the nominal FLB interest rate and current land prices to calculate opportunity costs for land overestimates land charges and total unit costs relative to observed commodity prices because this procedure ignores the effects of inflation. Current interest rates include an inflation component. Inflation also creates capital gains on land. Thus, if one uses nominal interest rates to estimate annual land costs, one should also include capital gains on land as a return—in addition to current returns from product sales.

Imputed charges for management and labor also pose conceptual and estimation problems when enterprise costs are established. Under current procedures, one includes the management fee in crop budgets by charging 10 percent of variable, machinery ownership, and general farm overhead costs and in livestock budgets by charging 7 percent of the same components excluding livestock purchased. These rates are intended to approximate the fees professional farm-management firms charge for managing farms. However, it is unrealistic to assume that these flat rates approximate opportunity costs for all farm operators or that they should be applied equally for all commodities in all regions.

The requirements of the 1973 act concerning management charges could not be literally fulfilled. Industries directly comparable to agriculture and observable management fees comparable to those of business owners in other industries are not readily available. Furthermore, imputing comparable management returns by approximating a professional fee is inappropriate because the management component in a national average is supplied primarily by farm operators, not by professional farm managers. Basing management returns on an arbitrary percentage of costs may also incorrectly escalate the estimated management return when other costs rise. The likelihood that the percentage method will distort production costs greatly increases during periods when rapid inflation increases input prices.

New Methods

The economic principle guiding our proposed method for calculating and presenting COP estimates is to compare current returns with the value of inputs used in current production and to distinguish this comparison from investment costs which generate future returns.

In particular, the treatment of farmland must recognize implied investment and noncash returns flowing from investment in land. If future returns to assets are excluded (for example, realized after-tax capital appreciation of assets), then cost items should not include that portion of expenditures made for the express purpose of gaining future returns to assets. Rather, cost items should include only those costs necessary for generating current returns. If the farm enterprise budget costs are to be comparable with income from produced output, then the appropriate opportunity cost for land should be based only on the contribution of land to the current year's production.

This procedure requires some measure other than nominal interest rates (as previously required by law) as the basis for calculating the current year's land charges. Unfortunately, the appropriate method of valuing anticipated capital gains has yet to be settled (*1, 2, 6, 7, 8*).

Revised Format with the New Methods

Table 1 presents corn production costs for 1979 through 1981 under current procedures. Table 2 uses new methods for allocating returns to operator-supplied factors to estimate costs and returns for producing corn in the United States for the same 3-year period. Table 2 contains three major sections: (1) cash receipts, (2) cash expenses and returns, and (3) economic costs and returns to owned inputs, management, and risk.

Cash Receipts

Under the revised format, cash receipts include the current year's returns from primary or secondary products, excluding Government payments (table 2). Program payments are made when policymakers determine that market returns are either insufficient to provide adequate income in the short run or to elicit the desired level of production in the long run. Furthermore, program payments are often made in conjunction with production adjustments which affect costs. Because policymakers need to assess conditions without programs to evaluate the need for and benefits of programs, cost information should exclude payment and cost adjustments.

In 1981, total returns were $268.03 per acre, reflecting a national season average corn price of $2.45 per bushel and an average yield per planted acre of 109.4 bushels.

Cash Expenses and Returns

The revised format breaks cash expenses into variable expenses and fixed expenses. Variable expenses are those incurred only if production takes place. Items in this category include seed, fertilizer, lime, chemicals, custom operations, fuel, repairs, irrigation, and drying—all of which are identified in the current format.

Table 1—Corn production costs, United States, current methodology

Item	1979	1980	1981
	Dollars per planted acre		
Variable:			
Seed	12.41	14.23	16.26
Fertilizer	37.55	47.28	52.58
Lime	1.18	1.38	1.53
Chemicals	13.27	14.24	15.49
Custom operations	4.44	4.77	5.52
Labor	12.03	12.98	14.92
Fuel and lubrication	12.53	17.12	20.26
Repairs	8.99	10.25	11.82
Drying	6.36	6.62	8.60
Purchased irrigation water	.08	.09	.10
Interest	4.27	6.28	7.96
Total	113.11	135.24	155.04
Machinery ownership:			
Replacement	23.00	25.29	28.73
Interest	14.29	19.61	25.11
Taxes and insurance	3.36	3.73	4.24
Total	40.65	48.63	58.08
Farm overhead	8.62	8.87	9.83
Management	16.24	19.27	22.29
Total, excluding land	178.62	212.01	245.24
Land allocation:			
Composite, current value	107.91	133.73	138.84
Composite, acquisition value	59.32	65.58	64.03
	Bushels		
Yield per planted acre	109.6	90.1	109.4
	Dollars per bushel		
Variable	1.03	1.50	1.42
Total, excluding land	1.63	2.35	2.24
Total to a renter:			
Share renter	2.43	3.67	3.40
Cash renter	2.18	2.93	2.83
Average renter	2.30	3.27	3.10
Total, including land:			
Composite, current value	2.65	3.93	3.71
Composite, acquisition value	2.13	3.05	2.90

Note: Composites include land allocation at average of share rent, cash rent, and charge based on current or acquisition value of owner-operated land.

The interest on operating capital (table 2) is the actual cash amount the operator and landlord pay. We explain a return to the equity capital used to purchase operating inputs in the following section on economic costs. For 1981, we assume that 32 percent of the annual capital needed to purchase inputs was financed at the Production Credit Association's (PCA) annual interest rate of 14.6 percent.

Table 2—Corn production costs and returns, United States, revised methodology

Item	1979	1980	1981
	Dollars per planted acre		
Cash receipts:			
Corn	276.19	283.81	268.03
Cornstalks	0	0	0
Total	276.19	283.81	268.03
Cash expenses:			
Seed	12.41	14.23	16.26
Fertilizer	37.55	47.28	52.58
Lime	1.18	1.38	1.53
Chemicals	13.27	14.24	15.49
Custom operations	4.44	4.77	5.52
Hired labor	0	0	0
Fuel and lubrication	12.53	17.12	20.26
Repairs	8.99	10.25	11.82
Drying	6.36	6.62	8.60
Purchased irrigation water	.08	.09	.10
Management fees	0	0	0
Storage	14.62	11.94	14.50
Interest on operating capital	1.28	1.88	2.55
Total variable expenses	112.71	129.80	149.21
Taxes and insurance	8.11	9.25	9.70
General overhead	8.62	8.87	9.83
Interest	20.25	27.42	32.29
Total fixed expenses	36.98	45.54	51.82
Total cash expenses	149.69	175.34	201.03
Receipts less cash expenses	126.50	108.46	67.00
Capital replacement	23.00	25.29	28.73
Receipts less cash expenses and replacement	103.50	83.18	38.27
Economic costs:			
Variable expenses	112.71	129.80	149.21
Taxes and insurance	8.11	9.25	9.70
General overhead	8.62	8.87	9.83
Capital replacement allowance	23.00	25.29	28.73
Total	152.44	173.21	197.41
Returns to owned inputs:			
Operating capital (equity)	2.99	4.40	5.33
Other nonland capital	5.34	6.13	6.88
Land	59.07	71.27	70.92
Unpaid labor	12.03	12.98	14.92
Residual to management and risk	44.32	15.82	−27.39
Net returns to owned inputs	123.75	110.60	70.56
Prices for corn (dollars/bushel)	2.52	3.15	2.45
Yield per planted acre (bushels)	109.60	90.10	109.40

Hired labor and paid management fees represent two new cash expense items included in the variable expenses section. A return to operator-supplied labor and management is included in the economic cost section. Although both hired labor and management fees are zero in this example, future surveys will provide actual cash payments.

Cash storage expenses are included to the extent that farmers must store grain after harvest to realize the season average price used in determining returns. Information on the method and type of equipment used to store grain on farms is not currently available, but will also be provided by future surveys. As with unpaid labor above, the noncash costs of storage will be included in the economic cost section. The cost shown in table 2 is based on the annual Government storage payment rate of $0.265 per bushel. We assume the corn must be stored 6 months to realize the season average price.

The budget does not include any cash premiums paid for crop insurance. This omission is consistent with the fact that indemnity payments do not appear as a return in the value of production section.

Fixed cash expenses include general farm overhead, taxes, insurance, and interest. These cash expenses are incurred whether or not production occurs. Taxes and insurance include personal property tax and insurance on machinery and equipment and real estate taxes paid on the land. Interest on nonland and land debt includes cash interest payments made by owner-operators and landlords. Principal payments are not included because they reflect a change in equity.

In 1981, average machinery investment per acre of corn planted totaled $171.99. Here, we also assumed that 32 percent of the $171.99 machinery investment per acre was financed at the nominal PCS annual interest rate of 14.6 percent.

We estimated cash interest paid on land debt in the example using the current 1981 land value of $1,733 per acre. Because 88 percent of the land is owned debt free by owner-operators and landlords and the remaining 12 percent of owned land is encumbered (*11*), we arrived at the total interest per acre by first multiplying $1,773 per acre by 12 percent and then by the average FLB interest rate of 11.4 per-

cent. Future surveys will provide cash interest paid on machinery and land debt.

Subtracting the variable and fixed cash expenses from cash receipts leaves net cash income before replacement of depreciable assets. Excluding income taxes, this amount is the discretionary income that can be used for debt retirement, family living expenses, depreciable asset replacement, or other investments. It represents a shortrun financial indicator of the operator's cash flow position for the average acre (for example, an acre of corn).

The capital replacement allowance is estimated just as in the current budget. As mentioned earlier, even though operators can postpone replacement of machinery and equipment in some years, over the long run they must replace both as each wears out. Net cash income after capital replacement leaves an amount that indicates longrun liquidity.

Economic Costs and Returns

The economic cost section of the revised enterprise budget attempts to place a value on inputs and resources required to produce the current year's crop without regard for ownership of the resource. If a resource is held with the expectation of receiving income from an additional source (for example, urban development rights), the calculated residual return will only cover that portion of the resource's value directly attributable to the production process. Any costs incurred for the express purpose of gaining an additional future return to the resource will be excluded.

The costs for variable inputs, taxes and insurance, general overhead, and capital replacement are the same in the economic cost and the cash expense sections. These expenses are incurred in the production process regardless of resource ownership. However, cash interest payments on debt are not included as economic costs because these payments vary according to the equity position of the resource owner. The cash expenditures of an owner with all assets debt free are significantly less than under situations with large amounts of debt, even though production takes place with similar technology. The economic cost section of the budget will allow comparisons of returns to the various enterprises without regard to the equity owners have invested in land and operating capital.

Subtracting variable expenses, taxes and insurance, overhead, and capital replacement allowances from cash receipts leaves the net returns to owned inputs—land, labor, and capital. We used the opportunity cost principle to allocate total net returns to these factors with residual returns to management and risk being the balancing factor.

We assumed that farmland and operating capital are solely committed to agricultural uses. Because ours is an enterprise analysis, the alternative use for these fixed assets, derived from the opportunity cost framework, is a different enterprise. Therefore, to allocate total net returns to owned factors, we used a 4-percent real rate of return for owned land and operating capital—a rate approximating the observed longrun return to production assets in agriculture for the past 30 years (*3, 5, 12*).

The average current per-acre value of land used in corn-producing areas in 1981 was $1,773. Multiplying this value by the 4-percent expected rate of return gives an annual resource cost of land of $70.92. Likewise, the average 1981 machinery investment per acre of corn planted totaled $171.99. If one uses the 4-percent return, the allocated cost was $6.88.

Determining the opportunity cost of operating capital is conceptually more difficult, as the capital set aside to purchase variable inputs is not fixed in the short run. Each year farmers decide either to pay cash for variable inputs of production or to leave available money in an interest-bearing account. Of the total annual operating capital required in 1981, 32 percent was borrowed, and the associated cash interest cost is included in the cash expense section under interest on operating capital. In the economic cost section, the remaining 68 percent of annual operating capital is multiplied by the annual average 3-month Treasury bill yield of 14.1 percent to obtain the opportunity cost of equity operating capital.

To calculate the allocation for unpaid labor, one must first ascertain the total amount of labor required (as determined by the old methodology) less the hours of hired labor. The implied amount of un-

paid labor provided by the operator, family member, or other individuals is then charged as a cost by use of a hired-labor wage rate.

After all the above costs and returns to owned inputs are subtracted from cash receipts, the return to management and risk remains as a residual. Although the return to risk over time would be expected to average close to zero, the return to combined management and risk should have a positive value over time, reflecting the managerial input needed to make operating decisions.

Conclusion

The proposed methods convey substantially more information about the financial situation of the enterprise. The difference between cash costs and economic costs is clearly distinguished. Different measures of net returns are also presented, each with its own distinctive use in describing various aspects of financial conditions in the farm sector. The new methods permit comparisons among enterprises. The difference between income received and the total cost of purchased inputs is the residual return to owner-supplied factors—land, labor, and management. Over time, this residual indicates returns to these operator-supplied factors on an enterprise-by-enterprise basis. This residual return is a good way to compare the profitability of enterprises and to understand shifts in enterprise levels.

This method allows us to more easily develop whole farm budgets, develop more useful information about the distinction of cash cost and returns, and develop comparisons of cash costs and returns by farm size, type, tenure, region, and commodity produced.

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Research Review

The Adjustment of Nominal Interest Rates to Inflation: A Review of Recent Literature

By Paul A. Sundell*

Introduction

Inflation has fallen markedly in the last 2 years, yet nominal short-term interest rates have declined far less. The resulting higher real short-term interest rates (the nominal short-term interest rate minus the actual rate of inflation over the maturity of the security) have weakened the credit sensitive sectors of the economy, including agriculture. Thus, a basic understanding of the theoretical and empirical relationship between nominal interest rates, inflation, and inflationary expectations is useful for agricultural decisionmaking.

I briefly review the basic theory of the adjustment of nominal interest rates and inflation in the first part of this article. The main conclusion is that the adjustment of nominal interest rates to changing inflation is probably slow and less than one-for-one, even in the long run. Moreover, the magnitude and speed of adjustment of nominal interest rates to changing inflation will depend on assumptions concerning price flexibility, the formation of price expectations, wealth, institutional constraints, and taxes. I examine selected empirical work on the adjustment of short-term interest rates to changes in inflation in the second part of the article. I examine particularly the empirical work of Fama in this area and the subsequent criticisms. I conclude, based on the theoretical and empirical evidence examined, that the expected real rate has been highly variable both on a cyclical and secular basis. The slow and incomplete adjustment of nominal interest rates to inflation contributes to this result.

Theoretical Overview

This section first examines the one-for-one adjustment of nominal interest rates in Sargent's classical model with perfectly flexible wages and prices. When the assumptions concerning wage and price flexibility and expectation formation are altered, changes in inflation will be accompanied by prolonged changes in real income and, therefore, in real interest rates. Moreover, other factors, such as inflation's impact on wealth, financial regulations, innovations, and taxes, also affect the relationship between nominal interest rates and inflation.

Classical Model with Rational Expectations

Recent empirical work on the relationship between real interest rates and inflation arises from tests of the hypotheses derived from the classical model with rational expectations and critiques of that model. As illustrated by Sargent (*56, 57*), *ex ante* and *ex post* real interest rates exhibit their least variability when the world is viewed in a classical sense, characterized by rapid wage and price adjustment, the absence of money illusion, and a rational expectations view of price expectation formation and real output determination.[1] In this classical framework, the economy tends towards full employment, with real interest rates determined jointly by many real variables, including the marginal products of labor and capital, the willingness to save in real terms, and the state of fiscal policy.[2] If these variables are nearly constant, the real rate will exhibit relatively mild variability.

Under these assumptions, the major source of variability in real economic variables will result from the errors in forecasting inflation. However, because expectations are rational, long periods of serially correlated errors in forecasting inflation will not exist, as recent forecast errors would be incorporated into forecasting future inflation. Thus,

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[1]Italicized numbers in parentheses refer to items in the References at the end of this article.

[2]Under very narrow assumptions, fiscal policy will not alter real interest rates. These assumptions include: (1) the perfect substitutability of Government and private spending, (2) debt neutrality, (3) no impact of fiscal policy on the supply of labor, (4) no long-term monetization of Government deficits, and (5) the absence of portfolio crowding-out or crowding-in. These narrow assumptions are analyzed by Buiter (*4, 5*) and Benjamin Friedman (*15*).

the expected real rate should differ from the actual real rate by only a random inflation forecast error term. Moreover, under this classical model with rational expectations, the expected real rate should exhibit only mild variability due to the allegedly mild nature of the business cycle.

In Sargent's model, if the Federal Reserve pursues an expansionary monetary policy, inflationary expectations will increase quickly and accurately (allowing for a random error term) because of rational expectations and frictionless Walrasian markets. The increase in inflationary expectations will raise nominal quantities, such as nominal wages, gross national product (GNP), loanable funds, and interest rates, by the expected increase in inflation, leaving these real quantities unchanged if expectations concerning future inflation prove accurate. If expectations prove inaccurate, real income will change, thereby causing shifts in the relative demand and supply of real financial assets that alter real interest rates. However, because of the relatively short adjustment period for expectations and desired real quantities, real variables will quickly move back towards their longrun equilibrium values.[3]

Criticisms of the Sargent Analysis

Four main categories of criticisms exist concerning Sargent's conclusion of a rapid approximately one-for-one change between inflation and interest rates. The first line of criticism is the prolonged impact of inflation on real income due to contractual rigidities in labor and product markets, information and adjustment costs, and uncertainty over the true economic structure, particularly when economic relationships change (*1, 4, 5, 7, 19, 21, 24, 25, 31, 32, 33*). In this view of the world, even with anticipated monetary expansion, the price level will not rise sufficiently, especially in the short run, to leave real income and real interest rates unaltered (*4, 5, 38, 56, 57, 62*). Higher real income will lower real interest rates if net saving by consumers responds more to real income change than does the net demand for loanable funds by other sectors. This criticism is particularly valid given the Federal Reserve's strong emphasis on targeting nominal interest rates in the past. The emphasis on targeting nominal interest rates tended to accommodate demand shocks originating in the real sector caused by changing inflationary expectations (*8, 22, 27, 40, 54*).

A second major criticism is that the Sargent analysis inadequately considers the role of wealth in determining nominal interest rates. Wealth enters the analysis because real savings are normally viewed as a negative function of the level of real financial wealth, whereas the demand for money is often viewed as a positive function of wealth. As real financial wealth increases, there is less incentive to accumulate more. Moreover, as wealth increases, individuals may want to hold more money balances to maintain or reduce portfolio risk (*29*, pp. 123-46, *65*). Therefore, higher inflation, by reducing real financial wealth, should stimulate greater savings out of income and should reduce the demand for money balances, thus placing downward pressure on real interest rates.[4]

The third major criticism is that the Sargent analysis ignores institutional factors concerning financial regulation and innovation. Most narrow monetary aggregates earn no interest or are under interest ceilings; thus, as inflationary expectations increase, the real return from holding money will fall. The lower real return on money balances will

[3]This analysis ignores the costs of higher inflation, such as resource reallocation, as well as increased uncertainty and volatility in real and financial markets. These can ultimately be expected to raise interest rates and lower real economic growth. In addition to raising the absolute level of interest rates, increased uncertainty concerning inflation will likely alter the term structure of interest rate by raising liquidity premiums on longer term debt. These and other costs of inflation are summarized by Frohman, Laney, and Willet (*23*) and by Hughes (*30*).

[4]Higher inflation and inflationary expectations will reduce wealth through three main channels. First, an increase in the price level will cause a fall in the real value of any given level of nominal financial wealth. An example of this negative wealth effect is the decrease in real money balances caused by anticipated inflation in the basic Sargent model. Second, higher inflationary expectations by raising nominal interest rates will depress prices on Government interest-bearing debt. Thus, to the extent that interest-bearing Government debt is net wealth to the private sector, higher nominal interest rates will depress private wealth (*27, 28, 34*). Third, if higher inflationary expectations increase the variance of inflationary expectations or reduce expected real profitability due to tax distortions caused by inflation, equity prices will fall, thus further depressing real wealth (*2, 12, 35, 60*).

create an incentive to reduce money holdings, thereby increasing the supply of loanable funds, reducing real interest rates in the short run, and increasing the capital stock and output in the long run (*4, 5, 48, 65*).

Moreover, when open market interest rates have risen above regulated interest rate ceilings on time and savings deposits, the availability of consumer credit has fallen. During these periods, consumers as savers have taken greater advantage of open market savings instruments such as Treasury bills and money market mutual fund shares. Thus, when higher inflationary expectations have driven nominal interest rates above interest rate ceilings in the regulated market, consumers as a whole have become greater net suppliers of funds to the open market, reducing real interest rates in the open market (*42, 50*). Continuing deregulation of depository institutions should strengthen the link between inflationary expectations and nominal interest rates by reducing the importance of "nonprice" terms (such as loan-to-equity ratios, credit standards, collateral requirements, and loan maturity) in allocating credit and lessening the impact of inflationary expectations on real income by reducing the interest sensitivity of the demand for narrowly defined money (*39*).

Fourth, the Sargent analysis ignores the joint influence of the tax system and inflationary expectations on nominal interest rates (*12, 35, 37*). The major influence of the tax system on nominal interest rates is the tax deduction for nominal interest expenses and taxation of nominal interest earnings. This treatment of interest income and expenses forces nominal interest rates to rise by more than the increase in inflationary expectations to maintain a constant, real after-tax interest rate. However, measuring the exact impact of the joint influence of inflation and the tax system is difficult in the presence of inflation's other influences on real income, wealth, and institutional considerations that also determine nominal interest rates. Despite this problem, empirical evidence indicates that reduced form models, which explicitly include average marginal tax rates, predict nominal interest rates better than models that do not (*51*).

However, several factors suggest that the adjustment of nominal interest rates to higher inflationary expectations will be less than the full amount required to maintain constant, real after-tax interest rates. First, in an inflationary environment, the tax system raises the real tax liability of the firm by underallowing real depreciation expenses and generating inventory profits (*12, 35, 46, 60, 61*). Because inflation raises the real tax liability of the firm, the demand for loanable funds by corporate borrowers will ultimately not increase by the full increase in inflationary expectations. Second, real government and public utility borrowing is likely to decrease as higher inflation generates higher net real revenues for the Federal Government and as interest rate ceilings and other regulations constrain real borrowing by municipal governments and public utilities (*2*).

Empirical Overview

In this section, I examine the empirical work of Fisher and Fama on the adjustment of nominal interest rates to inflation and summarize the major criticisms of Fama's work, particularly by Summers and Miskin. Overall, the empirical work supports the view that nominal interest rates adjust slowly and incompletely to inflation so that real rates are highly variable both cyclically and secularly.

Critiques and extensions of work Fisher did half a century ago comprise the main body of recent empirical work on the relationship of nominal interest rates and inflation. Fisher assessed the impact of inflation on interest rates by examining correlations of the yield on long-term bonds in England and United States with various measures of inflation (*13*, pp. 418-20). The correlations between contemporaneous bond yields and inflation were negligible, but were substantially larger when an arithmetically declining weighted average of past inflation rates replaced the current inflation rate. For example, from 1898 to 1924, the highest correlation coefficient (0.857) for long-term bonds occurred with a 20-year lag on inflation. For commercial paper, from 1915 to 1927, the optimal lag was found to be 30 years (*13*, pp. 423-27). Fisher rationalized the long lag not on the grounds of 20- and 30-year lags in inflation expectation formation but through the impact of inflation on real interest

rates and through the impact of past business activity on current economic and credit conditions (*55*, pp. 201-04). Thus, Fisher viewed the adjustment of nominal interest rates to changing inflation as a very longrun process.[5]

Fama has produced the best known recent empirical work concerning inflation and nominal interest rates. Fama performed two tests on the joint hypothesis of a constant expected real rate and market efficiency. Markets are efficient if they fully reflect all relevant available information. "Fully reflect" means that security prices should adjust rapidly to new information so the expected return on a security always equals the expected return at market equilibrium. Thus, no excess returns can be expected above the equilibrium return and the expected real returns from comparable investments should be equal. This analysis implies that forecasts are the most accurate possible, given the information set, because if information could be used more effectively, the opportunity for long-term economic profit would exist. To test the efficient markets hypothesis, researchers have employed various definitions of the relevant information set used in determining the expected return. The information sets have included merely past data on the time series in question (weak-form efficiency), other easily obtainable information relevant to that series (semistrong efficiency), and costly and difficult-to-obtain insider information (strong-form efficiency).[6]

Fama's first test of the joint hypothesis was a weak form test using correlations of real returns on 1- to 6-month Treasury bills for the 1953 to mid-1971 period. Fama concluded that his joint hypothesis was supported as the estimated correlations were close to zero. In his view, the market had used information on past real Treasury bill interest rates to price Treasury bills so that no longrun returns above the assumed equilibrium constant real return were available. Thus, deviations above or below the equilibrium real return will be transitory, and data on past real Treasury bill interest cannot be used to predict the transitory deviations.

Fama's second test was a semistrong test using data on real returns on 1- to 6-month Treasury bills and the Consumer Price Index (CPI) from 1953 through mid-1971 and subsamples of this period. He tested the joint hypothesis that the expected real rate of interest is roughly constant over time and that the market forecast of inflation incorporated in the Treasury bill rate is efficient so that all information used in forecasting inflation is summarized in the relevant Treasury bill rate. Fama represented the relationship between inflation and interest rates as $\% \triangle CPI_t = a + b\, R_{t-1} + u_t$ where CPI_t is the CPI in period t and R_{t-1} is the nominal interest rate one period earlier for a security with a maturity of one period.[7] The intercept term represents the negative of the *ex post* real rate over the sample period. Furthermore, for the joint hypothesis of market efficiency and a constant expected real rate, the coefficient b should not be statistically different from 1 and the residuals should not be autocorrelated. If the equilibrium expected real rate is constant, as suggested by a coefficient not significantly different from 1, autocorrelated errors would indicate the market is not using all information efficiently, as errors in forecasting the last period's inflation could be used to improve inflation forecasts in subsequent periods. Furthermore, if R_t implicitly includes all relevant information in forecasting inflation, the explicit addition of more information relating to forecasting inflation, such as lagged inflation, should not improve the equation's forecasting ability.

Fama estimated his equation for 1- to 6-month bills over the period from March 1959 to July 1971. The results generally supported his hypothesis in that

[5]Fisher rationalized these long lags by stating borrowers and lenders tended to form inflationary expectations differently. In Fisher's opinion, borrowers alter their expectations more rapidly and more correctly than lenders do. Therefore, an increase in inflation will raise the nominal rate of interest, although by less than the rate of inflation expected by borrowers, thus decreasing the *ex post* real rate. The falling real rate and increasing profits further increase loan demand and set the business cycle in motion. Savers, who form their expectations more adaptively, will eventually perceive the higher inflation and will be less willing to save at all nominal interest rates. Furthermore, commercial banks will be less willing to expand the money supply as inflation and higher loan-to-deposit ratios will reduce their willingness to extend new loans. The higher interest rates demanded by suppliers of funds will push nominal interest rates upward and expectations of inflation downward for investors reducing investment, overall economic activity, and eventually interest rates. (See *3*, *13*, and *55* for a detailed explanation of the Fisher's business cycle and his empirical work.)

[6]For a detailed description of the efficient markets literature and its applications in modeling interest rates, the interested reader should refer to (*9*, *10*, *43*, *44*, *45*, *47*, *52*, *53*, *58*, *63*).

[7]Fama used the rate of change in the purchasing power of money which is approximately equal to the negative of the inflation rate. However, as Wood pointed out, other than altering the expected signs for the right-hand side variables, the substitution of inflation for the rate of change in the purchasing power of money should not significantly alter the test results. Thus, to simplify comparison with the empirical work of others, I used the inflation rate instead of the rate of change in the purchasing power of money.

the slope coefficients for the interest rate generally did not significantly differ from 1, the estimated residuals were not autocorrelated, and the addition of the lagged CPI to the model was not statistically significant.

Criticism of Fama's Work by Summers and Wood

As might be expected, the Fama article received extensive criticism because the empirical results indicated a strong link between inflation and interest rates and little variability in expected real interest rates. His results generally implied a weak role for discretionary monetary policy if monetary policy's success depends primarily on sharply altering real interest rates. Subsequent empirical examinations of Fama's work have tested his equation for different sample periods, used real variables in Fama's equation to proxy for real variables influencing the real rate, have substituted different inflation proxies in Fama's equation, have developed reduced-form models for the determination of nominal interest rates with variables representing inflationary expectations and various and real monetary factors, and have real interest rates from different sample periods.

In the most detailed critique of Fama's work, Summers (*60*, pp. 57-61) fit Fama's equation to many more sample periods, including the seventies, and obtained highly variable results in terms of the slope coefficient values and significance as well as freedom from autocorrelation.[8] Summers' results for the post-World War II period are shown in the table. Given the extreme role the sample played in the results, the relationship between inflation and nominal interest rates appears highly variable.

Summers also examined the relationship between inflation and interest rates by modeling inflationary expectations. He modeled expectations under both a Keynesian (adaptive expectations) framework and a two-stage rational expectations framework to examine how rapidly nominal interest rates adjust to changes in inflationary expectations. These results likewise indicated that expected inflation's impact on nominal interest rates is highly variable over time and is significantly less than 1 even in the post-war period (*60*, pp. 52-61).

The fact that the relationship between inflation and interest rates seems rather weak and variable when one uses quarterly data does not preclude a tight longrun relationship. As mentioned in the introduction, such factors as the reduced demand for money balances, partially accommodating monetary policy, and incomplete real income and price effects may tend to weaken and add to the variability of the shortrun relationship between inflation and interest rates. To examine the relationship between

OLS regressions of the quarterly inflation rate on 3-month T-bill rates

Period	Constant	$\overline{R}_t$	R^2	D-W
1947-79	−0.31	1.14 (.12)	0.37	1.18
Omitting controls[1]	− .06	.31 (.14)	1.19	
1947-55	6.33	−2.94 (1.82)	.04	1.37
1956-65	.85	.32 (.33)	.00	1.80
1966-75	−3.32	1.59 (.24)	.51	1.53
Omitting controls[1]	−.43	.96 (.26)	.30	1.74
1950-59	2.06	−.18 (N.A.)	−.02	1.06
1960-69	−1.82	1.12 (.14)	.61	2.07
1970-79	−2.78	1.66 (.19)	.65	1.87
Omitting controls[1]	−2.31	1.56 (.23)	.61	1.85

Notes: Standard errors are in parentheses.
N.A. = Not available.

[1]These regressions were omitted in the period 1971:3 through 1974:2

Source: (60, p. 61)

[8]A small amount of autocorrelation could be introduced in the residuals of the Fama equation by transactions costs and changing liquidity premiums. Transactions costs can create autocorrelation by creating a range for the expected rate of return whereby short-term portfolio shifts would not increase expected revenue sufficiently to offset the higher transactions costs. Likewise, if the liquidity premium on a security changes, the expected real return on the security will change, possibly introducing autocorrelation in the Fama equation. The role of transactions costs and liquidity premiums in determining interest rates is discussed in Benjamin Friedman (*17, 18*), Malkiel (*41*), and Throop (*63*).

inflation and interest over longer periods (2 - 20 years), Summers used band spectrum regression, a statistical technique which uses moving averages of the data to reduce the impact of random and cyclical factors (*60*, pp. 21-35). Summers found the relationship between interest rates and inflation no stronger in the long run, as all coefficient estimates were far below unity and were once again highly sensitive to changes in the sample period. Summers concluded that money illusion is primarily responsible for the lack of a one-to-one relationship between interest rates and inflation in the long run (*60*, pp. 47-50).

Wood agreed with Summers' conclusion that the relative impact of inflation on nominal interest rates is highly variable and noted that, with the exception of Fama's sample period, the relative variability of inflation has been much greater than the relative variability of nominal interest rates (*68*, p. 11). Wood emphasized that the reduced volatility of inflation during Fama's sample period undoubtedly improved the ability of the market to forecast inflation, thus tending to yield more accurate inflationary expectations. Another contributing factor, according to Wood, was the relatively mild business cycles of the 1953-71 period tested by Fama, thus reducing real income effects on real interest rates.

Other Criticisms by Carlson and by Nelson and Schwert

Summers' and Wood's rejections of Fama's conclusions were primarily based on their inability to find a tight, statistically stable relationship between inflation and interest rates over various sample periods. In contrast, Carlson, Nelson and Schwert, and other researchers have produced evidence indicating Fama's conclusions are not correct, even for Fama's sample period.

Carlson criticized Fama's empirical findings on two major grounds. First, using the Livingston biannual survey data of market participants' expectations of inflation and nominal interest rates for the 1953-75 period, Carlson found a strong procyclical movement in expected real interest rates. The expected real interest rate tended to rise in expansions and to fall in contractions. According to Carlson, the procyclical behavior of real interst rates was due primarily to fluctations in the expected returns to capital (*6*, p. 470). However, using survey data as proxies for expected values has shortcomings. The major shortcoming is that all market participants do not need to have rational expectations to drive variables to rational values. If only a few market participants have rational expectations, but control a sizable share of market resources, economic variables can still be driven to levels consistent with rational expectations.

Second, Carlson found that adding the ratio of total seasonally adjusted employment to noninstitutional population to Fama's equation yielded a statistically significant coefficient and caused the coefficient for the 3-month Treasury bill to be statistically different from unity. These statistical findings indicate either that interest rates are not efficient predictors of inflation, because all factors influencing inflation are not being fully incorporated into the interest rate variable, or that the real rate is not constant. If the real rate is not constant, the addition of real variables should proxy for changes in the real rate of interest and be significant in predicting inflation in Fama's equation.

Other more sophisticated studies by Tanzi (*61*), Peek (*51*), and Wilcox (*67*) over similar sample periods, but not identical to Carlson's, that used the actual or modified Livingston survey data also indicated variability in the real rate.[9] These three studies used reduced-form equations to predict the 6- and 12-month bill rates with explanatory variables consisting of the actual or modified Livingston data, the business cycle, monetary and fiscal policy, and relative price shocks. The coefficient estimates were generally of the expected sign and were statis-

[9]Because the Livingston data proxies for unrevealed inflationary expectations, undoubtedly the Livingston data contain some measurement error. One source of measurement error is that all respondents do not respond at the same time; thus, some respondents would have access to later revised data. To the extent that measurement error exists in the Livingston data, some bias would exist in the coefficient estimates in the various reduced-form models for the 6- and 12-month bill where the Livingston data are used as a proxy for inflationary expectations. To produce consistent estimates for inflationary expectations variable, instrumental variables for the Livingston data were generated under various regressive, extrapolative, and rational expectations theories of expectations formation by Lahiri (*36*), Peek (*51*), and Tanzi (*61*). With the exception of the results by Lahiri, the adjusted Livingston data failed to raise significantly the coefficient on the inflationary expectations variable in the various reduced-form models estimated by Lahiri, Peek, and Tanzi.

tically significant. With the exception of selected model specifications by Tanzi and Wilcox, the coefficients on the inflationary expectations variables were significiantly less than 1 at the 5-percent significance level. Furthermore, when tax considerations were included in the models, none of the models produced a neutral impact of inflation on real after-tax interest rates.

Nelson and Schwert have also criticized Fama's results, noting that Fama's joint test of a constant real rate and market efficiency is weak because the variability of his error term is a composite of the variability of the market inflation forecast error and the variability of the expected real interest rate. Therefore, although the expected real rate may be variable and serially correlated, the error term in the Fama equation may indicate no serial correlation if the randomness of the inflation forecast error dominates the serially correlated *ex ante* real rate. Furthermore, the forecast errors of inflation will be larger if information is not used efficiently to make the best possible forecast. Thus, the serially uncorrelated observed real rates of interest and the serially uncorrelated error term in the Fama equation can be consistent with a variable real rate and market inefficiency as well as with Fama's hypothesis of a roughly constant real rate and market efficiency (*49*, pp. 479-80).

Furthermore, Nelson and Schwert stated that finding an insignificant value for the dependent variable lagged one period is a weak test to determine whether the interest rate variable contains all the information provided by past inflation rates. If the process generating inflation is not a simple one-period autoregressive stochastic process, the addition of the lagged dependent variable will be a poor test of determining whether interest rates efficiently incorporate all information concerning past inflation. Using univariate and multivariate time series analysis, Nelson and Schwert derived estimates of current inflation and replaced the lagged inflation variable in Fama-type equations with these estimates. The primary empirical results were that the time series predictors of inflation and the lagged error terms were both significant in forecasting inflation in Fama-type equations, thus providing evidence of either market inefficiency or variability in the real rate of interest.

Further Examination of *Ex Post* Real Interest Rates by Mishkin and by Hafer and Hein

Two major studies of the adjustment of real interest rates to inflation were performed by Mishkin and by Hafer and Hein. Both these studies were performed on observed *ex post* real interest rates under the assumption that if expectations are formed rationally, errors in forecasting inflation should be uncorrelated with available information as well as with actual, real *ex ante* interest rates. If this assumption is true, with the exception of random error, observed real interest rates over time should equal expected real interest rates (*26, 46, 59*).

The critical question is what time period is necessary for rational expectations to yield the correct underlying specification of the model and to obtain reliable coefficient estimates of the parameters determining real interest rates. Benjamin Friedman believes that a long time is required to obtain rational expectations in the Muthian sense, in which individuals' subjective probability distributions concerning future outcomes are equal to the objective probability distributions generated by the true model. Friedman believes the time is quite long because of the time required for the correct specification of the model to reveal itself, particularly in a dynamic, changing economy. Furthermore, finite sampling problems which exist in estimating the coefficients of the underlying model will lengthen the time necessary to obtain reliable estimates of coefficients (*19*).

Benjamin Friedman found empirical evidence of interest rate expectations being biased and inefficient in the Goldsmith-Nagan survey data from September 1969 to December 1976 (*20*). To test for bias, he requested the actual interest rates for six different money market and bond market interest rates on the last day of the quarter against average survey expectations formed 3 and 6 months earlier using Zellner's seemingly unrelated procedure. The results rejected the joint hypothesis of unbiased expectations across the equations at the 90-percent confidence level for the 3-month forecasts and the 99-percent confidence level for 6-month forecasts (*20*, pp. 456-59). Moreover, the error terms displayed serial correlation indicating inefficient use of information. To further test for the efficient use of information, Friedman examined the stochastic process

generating the actual interest rates and the average expectations in the survey. His results indicated that the actual and expected interest rates were generally generated by different stochastic processes, thus indicating inefficient use of information in forming expectations (*20*, pp. 459-60). Similarly, Mishkin found inflation forecasts were not used rationally in formulating long-term Government bond yields on a quarterly basis from 1959 to 1969, as market participants in the sixties consistently underestimated inflation in formulating long-term Treasury bond yields (*43*). The underlying caveat is that empirical tests using observed real rates as proxies for expected interest rates are generally suspect for relatively short sample periods or for longer periods characterized by unusual economic events.

Using correlation and regression techniques, Mishkin performed many tests on *ex post*, real 3-month Treasury bill rates. Like Fama, his first test examined correlations of observed real interest rates for the 1953:1 to 1979:4 period and found correlations significantly different from zero on an individual and collective basis, supporting the hypothesis that the *ex ante* real rate has varied significantly over most of the postwar period. In his second test, Mishkin regressed observed real interest rates for the sample period 1953:1 to 1979:4 on time variables up to the fourth power and also lagged inflation. The lagged inflation variable represented a subset of all easily available information known at the time the *ex post* interest rate is determined. The coefficient on lagged inflation was negative and significant, indicating, along with the significant time coefficients, that the *ex post* real rate varied over time and adjusted incompletely to inflation on a quarterly basis.

In his third test, Mishkin examined correlations of estimated real rates, nominal rates, and expected inflation. The estimated correlations of the fitted values for expected real interest rates with nominal interest rates and expected inflation were found to be −0.67 and −0.86, respectively, with expected inflation equal to the nominal rate minus the estimated *ex ante* real rate. Adjusting the real rate for an estimated effective marginal tax rate of 33 percent raised the correlation coefficients to −0.80 and −0.96. Moreover, the correlation of expected inflation and the nominal 3-month bill rate was found to be 0.95, which was not surprising as Mishkin's estimate of expected inflation was derived from the nominal interest rate. In short, his correlations support the view that an increase in expected inflation will raise interest rates, but by less than the full amount of expected inflation, thereby lowering the expected real rate particularly on an after-tax basis, at least in the short run.

Mishkin's analysis has several shortcomings. First, his model is based on time trends and is likely a poor approximation of the underlying structural model, particularly as substantial variation in the observed cyclical and secular real rate occurs in his sample period. One could have greater confidence in Mishkin's results if the structure for determining expected real interest rates were specified, not merely made a function of time trends. A more complete specification would reduce the possibility of specification bias through omitted variables. Either a multivariate Box-Jenkins time series approach or an econometric approach similar to the approaches used by Peek, Wilcox, and Tanzi would likely be superior. Mishkin's attempts to explain variation in *ex post* real rates by regressing the *ex post* real rate on lagged inflation and other time series were largely unsuccessful. Mishkin points out that these results are likely due to the greater variability in inflation forecasting errors relative to the variability in the *ex ante* real rate. However, many specifications other than those Mishkin used are possible. A second problem is that the CPI is a poor inflation proxy because of measurement problems, and the derivation of expected inflation from the nominal interest rate probably overstates the actual correlation of expected inflation and nominal interest rates. These criticisms are reviewed in detail by Singleton (*59*).

Hafer and Hein also examined *ex post*, real interest 3-month Treasury bill rates from 1955:1 to 1979:4. They found the average *ex post* real interest rate in the sixties statistically differed from the average real *ex post* interest rate for the last half of the fifties and throughout the seventies. The researchers also found statistically significant dummy variables for both the last half of the fifties and the sixties in the Fama equation estimated over the 1955:1 to 1979:4 period, further supporting the view the *ex ante* real interest 3-month bill rate was not constant over this period.

However, Hafer and Hein's small sample tests should be viewed with considerable caution. As mentioned earlier, if markets are using information efficiently, observed interest rates should be unbiased predictors of the underlying expected rates over time. The time period necessary for this degree of efficiency to occur will depend on the costs and the availability of information as well as on the degree of structural change in the economy. Given Friedman's and Mishkin's empirical results indicating that market interest rate expectations were biased and inefficient over most of Hafer and Hein's sample period, one should be hesitant in accepting small sample results concerning the longrun average equality of *ex post* and *ex ante* real interest rates.

Other research besides Mishkin's also indicates market participants habitually underforecasted inflation in the sixties and seventies. For example, Carlson found respondents in the Livingston survey underforecasted inflation on a biannual and annual basis from the midsixties to the midseventies (*6*). Fomby found similar results using *Business Week*'s and the American Statistical Association-National Bureau of Economic Research's quarterly macroeconomic surveys for the seventies (*14*). Market expectations likely underforecasted inflation because of the sudden upsurge in inflation and strong adaptive nature of the inflation forecasts over the period (*14, 36, 66*). Because of the apparent underestimation of inflation over much of Hafer and Hein's sample period, their results should be viewed with caution.

Conclusion

The adjustment of interest rates to inflation appears a long process. The lags from inflation to inflationary expectations and the likelihood of significant income and wealth effects along with institutional constraints indicate that the adjustment is likely slow and is insufficient to prevent longrun impacts on real interest rates. Although the empirical work, particularly studies involving *ex post* real rates, should be viewed with some caution, the preponderance of evidence supports this view, particularly concerning after-tax real interest rates. Future adjustments will likely continue to be less than instantaneous. However, the greater use and availability of information, the continued phasing out of interest ceilings, the greater integration of international money markets, and the shift in 1979 to a monetary policy less concerned with targeting nominal interest rates should speed future adjustments somewhat.

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Role of Government in a Market Economy

Lowell D. Hill (editor). Ames: Iowa State University Press, 1982, 102 pp., $12.95.

Reviewed by Stan Daberkow

"What is the proper role of government with respect to agricultural markets?" (p. 27). *We* never learn what the *proper* role of Government is, but the essays in this book do tell us what seven well-known economists think about the Government's role. This book reproduces the Norton Lectures at the University of Illinois from 1979 through 1982. The lecturers were chosen for their variety of views ranging from "free-marketeers" to "anti-oligopolists." The former lament the declining market economy, whereas the latter press for continued consumer and taxpayer safeguards. Market definitions abound throughout the book, while macroeconomic, antitrust, export, and agricultural policies are recanted or championed.

Harold Breimyer offers a historical treatise on markets and concludes that the role of prices, although progressively subordinated, is still critical. According to Breimyer, we expect prices to distribute final products as well as to allocate factors of production, which in turn determine the distribution of income. These functions depend on the sovereignty of economic units, relatively easy and equitable access to physical resources, and the egalitarian aspects of industrial techniques. Breimyer finds that the second of these tenets is increasingly violated, which means that prices cannot fulfill their "heroic" purpose of guiding the economy. Although not fully developed, Breimyer's observations on Ricardian rents and depletable resources offer further insights into the role of prices.

Lowell Hill, the editor, raises the issue of evaluating market performance. Price-setting functions of supply and demand are being usurped by Government legislation, executive action, administrative decisions, and manipulative corporations. However, "there is no well-organized system for evaluating the costs and benefits of individual policy actions" (p. 18). Hill argues that, although the perfectly competitive market is the standard by which we often judge all markets, such a comparison is unrealistic. Rather than compare entire market systems, one should compare the effects of policy A with policy B on a variety of criteria. He suggests the following criteria: efficiency, price level and stability, response to changes in supply and demand, and incentives. Stressing the direction of incremental movements rather than magnitude, Hill maintains that policy effects do not always have to be quantified. He applies this technique to a proposed national marketing board and cites past research bearing on each criterion. I find this approach overly optimistic. First, not all policymakers will agree on the criteria; for example, the Office of Management and Budget Director may insist on limiting budget exposure. Second, immense pressure will build to quantify the effects on markets and economic agents involved. Third, we are unsure how to aggregate across these diverse criteria. Fourth, as new policy proposals arise, we will inevitably discover that because agricultural economists have not excelled at anticipatory research, analysts are left to their own makeshift, and often hurried, devices.

John Kenneth Galbraith, in his characteristically entertaining manner, discusses economic change and the response of economic policy. Noting that "economic policy regularly lags behind compelling historical changes" (p. 32), he speculates that past Government response may not work in the future because economic relationships change. At the time of his lecture, policymakers were attempting to deal simultaneously with unemployment, inflation, and international exchange fluctuations. Dismissing several commonly cited culprits such as oppressive taxation, unions, public regulation, and the Organization of Petroleum Exporting Countries, Galbraith identifies three basic factors underlying economic change.

First, worker productivity has declined because of increased demand for leisure. "What is called the work ethic has always been thought exceptionally ethical for the poor. Those who have never experienced hard toil have always been indignant over the casual tendencies of those who have" (p. 32). Second, we no longer have occupational limits on

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consumption; that is, nearly all income classes have access to most goods and services. Third, certain organizations have successfully escaped market authority. "No industrial country now leaves its farm prices to the market; when farmers dislike their prices, they no longer assail the buyers of their products. They turn their wrath on the government" (p. 35).

Finally, Galbraith examines how monetary policy and fiscal policy have (or should have) accommodated these underlying economic changes, all the while vigorously criticizing monetary policy and defending Keynesian fiscal policy.

Willard Mueller presents a spirited case for social control of market power. "The great weight of empirical evidence supports the view that today market power is the rule" (p. 42). He recalls abuses of market power from before the Sherman Antitrust Act through the settlement of the International Telephone and Telegraph case as chronicled in President Nixon's White House tapes. Oligopolistic industries impose excessive costs on consumers through extensive advertising, product proliferation, and inflated costs of manufacturing and distribution. Mueller also maintains that market power creates an inflationary bias in the economy as wages and prices have continued to rise in the face of declining demand. He argues that wage and price controls can work and have worked in the past and that some inefficiencies, price distortions, or resource misallocations are a minor byproduct of controls when compared with high interest rates, high unemployment, depressed profits, and capacity underutilization that accompany monetary or fiscal controls. Mueller delivered his lecture in early 1980 and correctly anticipated the extent of the economic slowdown necessary to arrest inflationary tendencies. However, he did not anticipate or mention the international pressures which often constrain U.S. corporate power.

With *Theodore Schultz,* in 1981, the lecture series abruptly shifted from the dangers of unbridled markets to the unfounded "prosecution of free markets" (p. 73). Schultz claims that the private sector is best suited to perform all economic activities except those in which the Government has a comparative advantage: providing national defense; maintaining civil order and mediating internal conflicts; producing and reporting agricultural statistics; enforcing grades, weights, and measures; determining property rights during produce exchange; supporting basic agricultural research (although with some reservation); and stabilizing overall prices. "No government which has abolished markets has been successful in modernizing agriculture" (p. 67). Schultz laments the confusion between market failure (often an argument for public intervention) and market disequilibriums, which are inevitable in a dynamic economy where one cannot escape risk or uncertainty. He also notes that the concept of externalities is not new to economics and that the regulatory approach is inefficient compared with charging an explicit price for the undesirable byproducts of production. Schultz does not address the issues raised by earlier contributors: the adverse aspects of monopoly or oligopoly tendencies in the agricultural input, processing, and marketing sectors.

D. Gale Johnson's lecture develops the theme of U.S. agriculture and the world economy by providing a historical perspective of international agricultural trade. Except for a few years between 1920 and 1970, the United States had not been a net agricultural exporter. Since 1970, U.S. agricultural exports have expanded rapidly, reaching the point where the prosperity of the agricultural industry is a function of world demand. Johnson dismisses three arguments commonly profferred to explain the comparative advantage of U.S. agriculture: high productivity due to favorable climate and land resources, large size of U.S. farms, and one of the highest land-to-worker ratios in the world. These factors existed before 1970 and, therefore, do not satisfactorily explain the recent growth of U.S. exports. Johnson attributes agricultural export growth in the seventies to modifications in U.S. agricultural and exchange rate policies, significant resource adjustment in agriculture since World War II, and the emergence of U.S. agriculture as a high-technology sector. Chief among these factors were the overvalued dollar and the support of U.S. agricultural prices above world levels prior to 1970. Johnson's discussion on maintaining U.S. agriculture's comparative advantage is much too brief. He does not address the issue of exporting processed, rather than raw, agricultural products or the problem of export subsidization by foreign competitors. He does point out that the current inconsistent agricultural trade policy imposes significant costs on

the Nation: "It is slightly ironic that we have been willing to undertake domestic programs and policies to achieve resource adjustments for export products but have generally failed to adopt similar measures for products we import or would import in the absence of protection" (p. 87).

Bruce Gardner, the final lecturer in the series dwells on U.S. macropolicies and agricultural programs in the eighties. His characterization of "supply-side economics" and his comparison of it with the more traditional explanations of how the economy works are interesting, but tentative. Gardner believes that, although the agricultural policy proposals of the current administration initially emphasized market deregulation and budgetary constraints, the 1981 Farm Act, with congressional assistance, looked much like the 1977 legislation. Gardner's opinion about the role of Government in the economy is clear: "I believe that government intervention in the commodity markets as a solution to agriculture's problems over the long term has been a costly delusion" (p. 99). Gardner concludes that further deregulation through lower price supports and payments, fewer acreage controls, and less export promotion will not substantially harm farmers because "the farm sector as a whole is much less affected by commodity programs than was the case twelve to fifteen years ago" (p. 101). I suspect, however, that the estimated $15-$20 billion U.S. Treasury outlays on FY 1984 farm price and income supports and export subsidies will reverse that trend. Gardner's brief remarks on the income redistribution activities of the Congress and the concept of supply and demand of legislation might well have been expanded.

Although the views of each lecturer are interesting and occasionally fascinating, the book lacks a well-focused theme. This difficulty stems from the diverse group of individuals involved, the wide variety of topics addressed (market definition, market evaluation, macropolicy, inflation, antitrust policy, agricultural policy, and trade policy), and the rapid change in the focus of economic problems during the time span of the lectures. In nearly all cases, the lecturers cited books or articles where their theories, hypotheses, or empirical work had been reported in greater detail. Thus, the book serves best as a reference to the past work, interests, and economic philosophies of the seven lecturers.

Economic Analysis and Agricultural Policy

Richard H. Day (editor). Ames: Iowa State University Press, 1982, 368 pp., $35.00.

Reviewed by Allen B. Paul*

Geoffrey Shepherd is a scholar, teacher, and advisor of solid achievement and wide influence. Many economists know him through his textbooks on prices, marketing, and agricultural policy. Now we have an attractive volume of 23 wide-ranging essays in his honor. The book was conceived on his 80th birthday by students and colleagues. About half of the essays have been published before, but some of these were revised for this volume. The other half are newly written or were adapted from unpublished papers.

The essays are preceded by a chapter authored by two of Professor Shepherd's sons. It provides a biographical sketch of the man ranging from his boyhood years in England to his teens in the harsh farming plains of Saskatchewan, Canada, to his long academic years at Ames, Iowa, and to his latter-day consulting assignments in Japan, Burma, Venezuela, Vietnam, Peru, Indonesia, and Paraguay. This chapter will provide a fresh view of Geoffrey Shepherd to many readers. The volume includes an appendix giving a complete list of Shepherd's numerous writings from 1929 to 1975.

The essays are of a generally high quality, but they cover a disparate set of topics. This choice results from the editor's decision to reflect the full range of Shepherd's interests in one volume. Each essay forms a separate chapter classified under one of four sections. The sections are entitled: values, analysis, and policy; the quantitative approach; research, technology and resources; and markets and development.

All chapters in the first section have been published before. They include the 1955 and 1956 articles by Shepherd in the *Journal of Farm Economics* and an excerpt from a Michigan State bulletin by Glenn Johnson on what an economist can say about values; the 1978 Snyder Memorial Lecture by Kenneth Boulding on some building blocks for creating a normative science, as suggested by the course of agricultural policies; the 1976 American Agricultural Economics Association Fellow's Lecture by Lauren Soth on what agricultural economists can contribute to public policy; a 1979 essay by Harold Breimyer for the National Planning Association on mental images that guide the thinking of agricultural economists; and a 1952 article by W. K. McPherson in the *Journal of Farm Economics* on the family farm as a policy goal.

The previously published articles in the second section include a paper combining the 1942 and 1944 articles in *Econometrica* and the *Review of Economics and Statistics* by Gerhard Tintner, giving a simple explanation of why there are business cycles, and a 1954 article by Karl Fox in the *Review of Economics and Statistics* on the measurement of demand. Fox also has added some historical and methodological discussions to his original article. The newly available essays include a paper by George Judge on the theory and practice of econometrics that argues for using prior information as well as sample information for estimation and hypothesis testing; a paper by Walter Fisher and Paul Kelley proposing a new method for selecting representative firms in linear programming; and a paper by Wen-Yuan Huang, Earl Heady, and Reuben Weisz describing recent models that combine a large-scale econometric model and a large linear programming model, involving two-way communication between them. Such hybrid models are proposed to answer questions about temporal and spatial attributes of production, prices, income, and related variables.

Most chapters in the third section are relatively new. T. W. Schultz provides a paper, originally given to a 1979 seminar in Chile, arguing that each major Latin American country should aim at having its own first-rate national agricultural research enterprises. The enterprises would produce valuable public goods and should be paid for on public account.

R. T. Shand gives his own interpretation of the 1979 joint study by the Indian Planning Commission and the Australian University. On the basis of

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his Indian experience, he questions most of the generalizations in the development literature on the impacts of the new crop varieties on production and income distribution. George Ladd reports on a cooperative study with university animal scientists using a product-characteristic approach to technical change. They applied ideas from Kelvin Lancaster's seminal work in 1971 to animal breeding. Robert Wisner reports on a study of the economics of gasohol which shows its relative costliness. Finally, John Timmons provides a chapter that was presented at a water resources seminar in 1969 explaining the concept of water quality in economic terms. It shows the varied nature of demand requirements and methods for managing supplies of different qualities to meet the different requirements.

Three chapters in the last section have appeared in print before. A paper by Richard Day, originally presented at the 1979 meetings of the International Association of Agricultural Economists, argues for a centralized economic policy of intervention based on the view that man's cognitive powers are limited and that economic systems tend toward disequilibrium rather than equilibrium. A 1958 article by Arthur Hanau, reprinted in English from the *Agrarwirtschaft,* gives the rationale for what later became the Common Agricultural Policy (CAP). A 1965 paper by G. Boddez, first presented at the Flemish Economic Congress in Louvain, explains the complex problems of the CAP as seen at that date. Boddez anticipated many of the difficulties facing the CAP today.

Then, there is a paper by Edward Schuh discussing the importance of foreign influences on the U.S. economy operating through capital markets and commodity markets. This subject apparently is overlooked by most analysts and policymakers. A paper by Frank Meissner argues that investments in capital-intensive marketing technologies in poor countries are unfortunate. To make economic progress, existing public markets should be modernized, services should be provided to entrepreneurs, and in-service training programs should be provided to wholesalers and retailers. Appropriately, the final essay is an adaptation of the 1968 and 1969 reports by Shepherd based on his experience as economic advisor in Peru. It sorts out the real problems of the country from popular perceptions of the problems, and it defines the most effective role of government as one of facilitating private marketing enterprises and of providing essential information.

So much for the book's contents. A few general comments should be made. First, while the volume honoring one of the most productive and influential scholars of our times is not a *Festschrift* in the usual sense of a collection of original writings for the occasion (although it has some of this quality), most of the papers would be fairly inaccessible if it were not for this volume. Second, while old articles are included, their age does not necessarily erode their relevance. For example, Tintner's cogent demonstration in the early forties of how speculative dealings in several different asset markets interact to cause booms and busts appears more relevant now than during the fifties and sixties when *we* were lured into believing that business cycles could be closely controlled.

Finally, the volume displays a good cross-section of what agricultural economists do. But what they do reflects different methodological predispositions. These predispositions influence the selection of topics, the results obtained, and the conclusions drawn. Readers who are concerned with how we gain valid knowledge will see a variety of approaches in these essays. For example, the clarity, rigor, and simplicity of Shepherd's approach is replicated in several chapters dealing with a variety of economic problems. On the other hand, the utter complexity of the evolving human experience sketched in Day's essay, which leads him to advocate a new brand of behavioral economics, calls for very involved modeling of economic phenomena. Perhaps the involved modeling described by Huang, Heady, and Weisz is a foretaste. Yet, does the current state of economic understanding warrant such effort? Bigger and more intricate models may not yield better policy advice.

How far removed are we from Boulding's law of political irony that says that "almost everything that you do to hurt people helps them and everything you do to help people hurts them" (p. 43)? Boulding playfully announced this dictum on observing that the unintended side effects of farm programs turned a bad public policy into a good one. He had taught that farm programs redistributed income in favor of richer farmers. But, it gradually

dawned on him that the overall effects were astonishingly successful. It enlarged average U.S. per capita income without reducing the share going to the poor. The unanticipated effects of price policy were to reduce uncertainty, thus stimulating investment to modernize agriculture and thereby increasing productivity and forcing the rural poor to seek employment in the cities where they became more productive than before. Apparently, we still do not understand well enough the crucial bearing of uncertainty on the organization of production and output. Yet, do we know enough about the real costs of rapid population movements?

On this questioning note, I can commend this volume as a good vehicle for serious thought about important methodological issues in our profession. It could serve this purpose in graduate courses and elsewhere.

Agricultural Research Policy

Vernon W. Ruttan. Minneapolis: University of Minnesota Press, 1982, 370 pp., $32.50 (cloth), $13.95 (paper).

Reviewed by Lyle P. Schertz*

A limited, but yet significant, number of agricultural economists have studied the economic costs and benefits of agricultural research. Vernon Ruttan, professor at the University of Minnesota, is one of these economists. Ruttan has also focused on related but broader topics—the organization of research institutions and the management of agricultural research—the topic of his most recent book.

Most of his manuscript relates to biological and technical research, but not exclusively. Important portions of the book relate to economic research.

I consider this book as part of the sustained effort by many—including Theodore Schultz, Sterling Wortman, George Harrar, and F. F. Hill—to search out the rightful role of research in agricultural development in lower income countries. It is fitting that a book focused on the art of organizing and conducting agricultural research be written by Ruttan. His experiences with the Tennessee Valley Authority, Purdue University, the Council of Economic Advisers, the International Rice Research Institute, the University of Minnesota, and the Agricultural Development Council provide him with unique perspectives about these topics.

The text is organized into twelve chapters. It focuses on induced innovation and incorporates many concepts included earlier in *Agricultural Development: An International Perspective,* published in 1971 with Hayami, and later in *Food Policy* in 1977. Ruttan describes selected national agricultural research systems. Focusing on the art and requirements of managing research institutions, he discusses the fostering of scientific creativity, improvement of reviews of research programs, location and size of research institutions, mix of private and public research, project versus grant funding, and ways to allocate public money. Chapter 10 is a good reference, for it summarizes past research by economists on the economic costs and benefits of agricultural research. Subsequent chapters focus on social science research and consider moral responsibilities confronting researchers and research administrators in recent years.

Many economists will want to become acquainted with this book, especially if they are engaged in interdisciplinary work, caught up in the USDA land-grant research planning processes, considering employment where they will be surrounded by biological and technical researchers or administrators of such research, or aspire to be administrators of research. The book will also appeal to economists interested in initiating research focused on why our society does not invest more in agricultural research when the findings documented in chapter 10 indicate that returns from additional investments in U.S. agricultural research would greatly exceed the costs.

Economists who now have administrative responsibilities or have recently been in administrative positions in the Economic Research Service and in departments of agricultural economics at U.S. universities will also want to be acquainted with the book. The book: (1) helps readers understand the evolutionary nature of the U.S. agricultural research system; (2) stimulates them to view U.S. agriculture in a developmental context, with technology as an important force influencing development; and (3) suggests that building research institutions is a tedious, difficult task requiring everyone's best skills and intentions, administrators as well as practitioners; and (4) reminds everyone that the time required to erode research capacity can be quite short relative to the time required to build or rebuild such capacity.

Ruttan is a careful writer. He does not make combative statements. But he is not meek in his pronouncement of judgment on the 1978 reorganization of ERS. He feels that the new organization did not clearly distinguish between staff and analytical functions, and he concludes that one of the outcomes was "further erosion of the analytical capacity that is needed in order to maintain the effectiveness of the staff function" (p. 325).

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The book stimulated me to think more about how our agricultural economics research institutions, and ERS in particular, might build for the future. Some of Ruttan's comments touch on questions critical to ERS. For example, Ruttan argues that "a major problem becomes how to renew the intellectual vigor of the mature research institute." He advises:

> If a research system is to remain a valuable social asset, it must also devote resources to reinvestment in institutional capacity, to the enlargement of its physical and intellectual capital (p. 47).
>
> This [leadership capability of mobilizing and allocating resources] means not only acquiring the necessary human and financial resources, but also performing the more difficult task of creating an institutional environment in which these resources can become productive (p. 49).

Ruttan has little patience for the concept of hiring outstanding people and letting them "do their own thing" (p. 48); "leadership must be sensitive to changing social goals, and it must effectively transmit their implications to the scientific staff" (p. 49). His rationale is based on the notion that many of our problems require "concerted research efforts," which I presume to mean research activity requiring in some cases several people and often more than one discipline. Many problems are of such a nature, and I applaud Ruttan's nudging of administrators to learn and to lead. But, it is not at all clear that administrators have a monopoly on being able to identify and define such problems.

Administrators have special responsibilities to see that researchers have opportunities to demonstrate leadership skills as well. I agree with Ruttan that administrators have a special responsibility to identify and define problems and, after the ideas are tested and found appropriate, to lead people to engage in the needed work. But I wonder if another need—the need to decentralize the control of some resources so that individual researchers can have the flexibility to identify, define, and respond to such problems—might even be of greater significance or, at least of equal, importance.

Administrators have a proclivity to centralize decisionmaking, even with respect to allocating money for support activities for professionals. Even when decentralization is pursued, it stops somewhere between those at the top of the hierarchy and those producing the primary products of the research organization. One reason university economists work hard to obtain contract money is to escape the inflexibilities imposed by centralized budget controls. These controls often limit activities important in accomplishing research objectives.

These reactions to Ruttan's admonitions about research leadership illustrate why I think many economists will want to read *Agricultural Research Policy.* The book is stimulating and encourages critical thinking about the way the research institutions to which economists belong and to which they relate are organized, managed, and led, and how researchers participate in building and rebuilding such institutions.

Suggestions for Submitting Manuscripts for *Agricultural Economics Research*

Contributors can expedite reviewing and printing of their articles by doing these things:

1. **SOURCE. Indicate in a memorandum how the material submitted is related to the economic research program of the U.S. Department of Agriculture and its cooperating agencies. State your own connection with the program.**
2. **CLEARANCE. Obtain any approval required in your own agency or institution before sending your manuscript to one of the editors of *Agricultural Economics Research.* Attach a copy of such approval to the manuscript.**
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9. **CHARTS AND OTHER ARTWORK. Use charts sparingly. Keep design as simple as possible. Submit all artwork in draft rather than in final form, accompanied by neatly prepared pages with essential data for replotting.**

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